

REMARKS

Claims 1-10, 12-14, 17, 20, 22-35, 37, 39 and 41-49 are in the application. Reconsideration and withdrawal of the rejections are requested in view of the following remarks.

The specification has been amended to update the related applications at [0001] and to add the new last line of [0105], which is from Col. 4, lines 63-67 of U. S. Patent No. 6,240,933 (Serial No. 08/853,649 incorporated by reference at [0001]) and described in new claim 42.

In view of the Examiner's comments at page 3 of the 5/12/2004 Office Action, Claims 1 and 35 have been amended to describe liquid heated to 25-200°C (from [0131]), and to more positively claim the action of the liquid jet. In view of those same comments, Claim 25 has been amended to describe diffusion of ozone through the liquid layer and chemical reaction of the ozone with the contaminants. Claim 4 has been amended to describe a liquid temperature range of about 40-97°C, also from [0131]. New claims 42-48 have been added with a view also to the Examiner's comments in the 5/2/2004 Office Action. Claim 46 is a step plus function claim.

Certain of the conclusions at page 3 of the 5/12/2004 Office Action merit discussion. Regarding the Examiner's comparison of Applicant's arguments filed 02//04 and the content of the claims, the present pending claims have been amended so that the arguments and claim language are of consistent. The conclusion at page 3 that "jetting the DIW by Matsuoka will obviously remove the contaminants" is contrary to the

disclosure of Matsuoka, as well as contrary to well known circumstances in wafer processing. Specifically, contaminants, such as photoresist, necessarily adhere tightly to the wafer surface. They are not easily physically removed via a spray of DIW, and especially not with a spray of DIW at an angle nearly parallel to the wafer surface, as in Matsuoka. Indeed, virtually all of the prior art cited here demonstrates the long standing and difficult problem of removing contaminants from wafers.

Enclosed is an Office Action from the corresponding application in Singapore (Application SG 2003 01801-7 as examined by the Australian Patent Office). In discussing Matsuoka (EP 548596 referred to as the D2 reference), the foreign examiner writes at page 3, section 2:

"However, the liquid in D2 is neither heated nor under pressure, and the water is sprayed onto the substrates from the side and hence does not impinge onto the substrates through the boundary layer. Claims 1-39 are therefore novel in light of D2." (emphasis added).

In this foreign office action, the examiner goes on to reject the claims for lack of inventive step over U.S. Patent No. 6,240,933. However, this part of the foreign office action is not relevant here because U.S. Patent No. 6,240,933 is prior art in the present U.S. application. (This application claims priority to U.S. Patent No. 6,240,933, but no such priority claim is made in the Singapore application). The important point here is that the enclosed foreign office action confirms applicant's conclusions stated above regarding Matsuoka: specifically, that Matsuoka does not disclose use of a jet to physically remove contaminants from a workpiece.

Regarding the comments on the pressures described in claims 3, 4 and 22, indeed, if the person of skill in the art is instructed to use a high pressure jet or column of fast moving liquid to impact the wafer and physically remove contaminants, then perhaps the claimed pressures could be determined using routine skill. However, since there is nothing in the prior art here suggesting any pressures to form a liquid jet to remove contaminants, the rejections of these claims necessarily and improperly relies on hindsight reasoning.

Regarding the final comment at page 3 of the 5/12/04 Office Action, combining a high temperature taught by JP '927, with Matsuoka, which expressly says do not use high temperatures, is clearly improper. When references teach away from each other, as here, they are not properly combined. Indeed, a person of skill reading Matsuoka would be led to avoid any temperatures above 20 or 25°C.

Turning to the first § 103 rejection, Matsuoka EP 548596 describes ultra-pure water "jetted" through a nozzle toward a substrate on a rotating table so that thin films of ultra-pure water are formed on the surface of the substrate (p. 5, lines 26-28). The "jetted" water forms a liquid layer. It does not penetrate or pass through an already-present liquid layer. There is nothing in Matsuoka to suggest that the "jet" of water physically removes contaminants (see Figs. 1-3, showing all nozzles 9 oriented to spray out substantially parallel to the workpiece surfaces). Rather, the "jet" in Matsuoka is a spray used to form a liquid layer. No other reason for the "jet" is provided in Matsuoka. Nor is a "jet" shown or described. All of the figures in Matsuoka clearly show a diverging spray pattern from multiple nozzles positioned at angles were little or no

physical impact on the wafer is possible. Matsuoka, taken as a whole, suggests spray, not a jet or a generally solid or continuous column of fast moving liquid.

Claims 1, 25, 35, 42, 46 and 48, on the other hand, describe use of a jet or column that penetrates through the boundary layer to physically dislodge contaminants from the workpiece. This concept is clearly not suggested in Matsuoka.

Regarding the temperatures, the claims have been amended so that all of the claims now describe a liquid heated to 25-200°C (claims 1, 25, 32, 42 and 46) or 65-99°C (claim 5) or 40-97°C (claims 41 and 48), *i.e.*, temperatures beyond those suggested in Matsuoka. Matsuoka expressly teaches away from heating, for example:

"Heating the substrates does not permit wet ozone to have well-enough effects, because any thin water film cannot occur even when a wet ozone-containing gas is fed." Matsuoka, p. 3, lines 34-35, and p. 4, lines 33-34.

Example 1 on page 5; and Comparative Example 1 on page 6 describe room only room temperature water. No heater is disclosed in Matsuoka. Accordingly, the claims cannot be obvious over Matsuoka because Matsuoka discloses neither physical removal of contaminants through impact of a liquid jet, nor use of a heated liquid.

Turning now to the second 103(a) rejections, Applicant agrees with the Examiner that none of Berman, Koizumi et al, Matthews and Kosofsky teach the temperature ranges as claimed. See Paragraph 4 on page 2 of the 11/13/2003 Office Action (paper No. 14). This leaves JP '927.

JP '927 (JP 'H04(1992)-125927) discloses a method of spraying hot sulfuric acid (which may include added water-containing ozone) onto the surface of a wafer in an ozone-containing atmosphere. As shown in Fig. 1, and as described in paragraph 55 of the translation, in JP'927, the wafers are first heated to 120°C using a heater, within a quartz tank containing ozone gas. The ozone gas, acting on the heated wafers, oxidizes organic material or contaminants on the wafer surface. Since the wafer surface is above boiling, it is clear that during this step, the wafer surface is dry, and that this is purely a dry ozone ashing process. When sufficient ozone gas in the tank is consumed, hot sulfuric acid (optionally including water containing ozone) is sprayed onto the wafer surface.

In JP'927, ozone gas reacts with contaminants on the dry surface of the wafer. In the claims, the surface of the wafer being cleaned is necessarily wet, due to the liquid layer formed on the wafer, and/or the jet of liquid impinging on the wafer. In JP'927, no liquid layer is formed. The wafers are also fixed in place and do not rotate. Consequently, there is no means for forming or maintaining a liquid layer.

JP'927 discloses a process temperature of 120°C. At this temperature the liquid would be boiling. Consequently, Matsuoka which describes a liquid layer, and JP'927, which describes a dry ashing process, cannot reasonably be combined. Thus, it is improper to combine the teachings of Matsuoka with those of a reference that teaches heating, such as JP '927. Accordingly, the cited references, alone or in combination, do not teach or suggest the claimed methods.

In view of the foregoing, it is submitted that the claims are in condition for allowance, and a Notice of Allowance is requested.

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